PATENT SPECIFICATION

744,770

Date of application and filing Complete Specification: March 10, 1953.

No. 6596/53

Complete Specification Published: February 15, 1956.

Index at acceptance: —Class 55(1), A8.

COMPLETE SPECIFICATION.

Improvements in or relating to Closures for Coke-Oven Chambers

I, JOSEPH LIMBERG, of Reginestrasse 51, Essen, Germany, a German Citizen, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to coke-oven doors and has for an object to provide improved coke-oven doors equipped with power operable locking and unlocking means. According to the present invention a coke-oven door of the kind having outwardly projecting walls so as to form a box-like body, which is equipped with locking mechanism including a bolt member mounted on the door body for rotary movement about an axis perpendicular to the plane of the door opening into and out of engagement with a pair of hook-shaped door holding abutments and fluid-pressure operable actuating device arranged inside the box-like body adapted to rotate a sleeve arranged coaxially with the bolt member and connected to the latter by screw threads so that continued rotation of the sleeve when the bolt member has engaged the hook-shaped abutments causes the bolt member to be raised from the door so as to force the door on to its seat.

In order that the invention may be more readily understood, one embodiment, together with a modification thereof, will now be described with reference to the accompanying drawings, in which:—

Fig. 1 is an outside view of the door,

Fig. 2 is a longitudinal section thereof,

Fig. 3 is a cross section, drawn to a larger scale and also showing part of the coke-oven structure,

Fig. 4 is a detail of Fig. 3 in a parallel section on line A—B of Fig. 5,

Fig. 5 is an elevation at right angles to Fig. 4 of the same detail in one adjustment position,

Fig. 6 is a view similar to Fig. 5 showing a different adjustment position,

Figs. 7 to 9 correspond respectively to Figs. 4 to 6 but show a modification, Fig. 7 being a section on line C—D of Fig. 8,

Figs. 10 and 11 are views similar to Figs. 1 and 2 respectively, showing the body of the door together with an extension member secured thereto.

Fig. 12 is a section across the door and through the door seat and part of a coke-oven structure and illustrates a preferred way of securing the door frames with which the coke-oven doors according to the invention co-operate.

Referring now to the drawings, Figs. 1 and 2 show the general arrangement of one form of a device according to the invention for locking and unlocking a door 12 seated in a door frame 4. Secured to the door 12 by means of support brackets 21*a* and 21*b* is an actuating device which comprises a cylinder 22 in which two pistons are displaceable which have not been shown, and which are rigidly connected to each other by a piston rod. Both pistons may be actuated by fluid under pressure acting upon their outer surfaces, which may be supplied through flexible tubes, not shown, leading to pipe connectors 22*f* at each end of the cylinders. The piston rod is constructed as a toothed rack and when the pistons are displaced, it actuates a toothed or friction pinion which is not shown, and which turns a shaft 22*a* having a square end 22*d*. This shaft is provided with rocker arms 22*b* having cranks 22*c* to which connecting rods 25 are pivoted, which each act upon the rocker arms 12*m* of a sleeve 12*a* and turn the latter as will be described below with reference to Fig. 3. When the pivoted connection between the connecting rod 25 and the rocker arm 22*b* is stretched in a straight line, a locking position is obtained in which it is impossible for the door to be undone unless and until the shaft 22*a* is turned either by the pistons or manually by the application of a square key to the square shaft end 22*d*. It is therefore, not necessary for the pistons in the cylinder 22 to remain under pressure.

The door and its closing means are shown in section in Fig. 3. The coke-oven door 12 is equipped with holders 13 arranged at the back of the door body for holding a block of firebrick or the like 13*a* and with a locking device secured at the front surface of the door, this locking device comprising a number of assembled parts 12*a* to 12*m*. The

[*Price 3s. 0d.*]

Price 25p

coke-oven door is so constructed that all those parts which are subject to greatly varying temperatures are exchangeably arranged. Since the door-locking device 12*a* to 12*n* is disposed at the side of the door facing away from the chamber and therefore is continually cooled by the outer air, it is only subject to temperature effects to a minor extent. It includes a spindle 12*b* provided with a foot plate 12*c* screwed to the door by screws 12*n*. The spindle 12*b* carries a loosely slipped-on rotatable sleeve 12*a* with a screwed-on threaded cap 12*d*. A torsion spring 12*e* is also secured to the sleeve 12*a* and the screw-cap 12*d*, being connected at one end 12*f* to the sleeve 12*a* and at its other end 12*g* to the screw-cap 12*d*. Slid upon an upper reduced part 12*h* of the spindle 12*b* is a bronze bearing bush 12*i*, the outer surface of which is provided with screw threads which engage a screw-threaded bore of a door bolt member 23. This screw connection makes adjustment of the bolt 23 relative to an abutment hook 24 possible while a pin (not shown) secured in the bolt member 23 and engaging the cap 12*d*, prevents during normal operation any relative rotation of the part 12*d*, 23 and 12*i*. The bronze bush 12*i* is double frusto-conically shaped at its inner surface in order to facilitate swivel movement about the reduced part 12*h* of the spindle 12*b*. Nuts 12*k* hold the bush 12*i* against the screw cap 12*d* in such manner that when the screw cap 12*d* is turned, the bush 12*i* is forced to participate in this movement. By means of the bolt member 23 and the hook shaped abutments 24, which are secured to the door frame 4 by means of screws 24*a*, pressure is exerted upon the door 12 to apply a metal sealing frame 26 of the door in a gas-tight manner against the door frame. When the sleeve 12*a* is turned on the spindle 12*b* by the action of the connecting rods 25 (Fig. 1) upon the rocker arm 12*m*, the bolts 23 are first tilted from the position shown in chain-dotted lines in Fig. 1 into the horizontal position as shown in full lines, whereupon further rotation of the bolt 23 and cap 12*d* is prevented by the hooks 24. When the sleeve 12*a* is turned further by the connecting rod 25, it will therefore, against the action of spring 12*e* rotate relative to the cap 12*d* so that the latter is raised by its threads axially of the spindle 12*b*, thereby pushing the bolts 23 with a considerable pressure of several tons against the hooks 24, thus forcing the door down onto its seat in the frame 4. Conversely when the sleeve 12*a* is turned back, the bolt 23 and cap 12*d* will at first be held against rotation by the friction between it and the hooks 24, so that the threaded part of sleeve 12*a* will turn in cap 12*d* and thereby reduce the axial pressure, the spring 12*e* assisting this release; thereafter the lever is once more moved to the chain-dotted release position according to Fig. 1.

If desired the screw-thread connection between the sleeve 12*a* and the member 12*d* by which the bolt member 23 is turned and raised may be replaced by suitably arranged cam surfaces producing a similar effect. The frame 26 is, according to Figs. 4 to 6 of Z-profile, while according to the modification shown in Figs. 7 to 9 this frame is replaced by a flat frame 27. In either case the frame must be adjustable relative to the door frame 4. The adjustability of the frame shaped sealing blades 26 and 27 is respectively illustrated in detail in Figs. 4 to 6 and 7 to 9 each in fragmentary section and in elevation. According to Figs. 4 to 6 the metal sealing frame 26 is sealed against the peripheral outer box walls of the door 12 with the interposition of a sealing gasket 40 and several sealing ropes 41 (the latter are essential for the final sealing). The body of the door is provided with specially formed grooves 41*a* for the accommodation of the sealing ropes 41. In order to secure the Z-section sealing frame 26, oval apertures 26*a* are provided in the sealing frame 26 (Fig. 5) which may be provided with an expansion slot 26*b*. A disc 26*c* eccentrically connected with a pin 26*d* is slipped into these oval apertures 26*a*. Arranged over the disc 26*c* is a second disc 26*e* (Fig. 4) which serves to indicate the position of the disc 26*c*. When the hexagon head 26*f* of the bolt 26*d* is turned, the eccentric disc 26*c* turns in the oval aperture 26*a* and moves the sealing frame 26 in both directions towards the door frame 4 (Fig. 6) and away from it (Fig. 5). This securing device of the sealing frame is arranged distributed on the frame.

According to Figs. 7 to 9 in contrast to the Z-section frame a flat frame 27 is provided as sealing frame which, with the interposition of an asbestos sealing gasket 40 and of a rope 41 arranged in a groove 41*a*, is connected with the door 12. The flat sealing frame 27 is provided with apertures 27*a* in which discs 26*c* are arranged similarly as in Fig. 5, but which are not closed to form an oval as are the corresponding apertures 26*a* in Fig. 5. Because the apertures 27*a* have only a semi-oval shape and are not closed, thus avoiding the necessity of making the relatively expensive metal frame 27, which is made from spring steel, unnecessarily wide, it is not possible in this case to move the frame 27 away from the door frame 4 by means of the discs 26*c*, which are in this case only effective for moving it towards the door frame 4. Between the two embodiments according to Figs. 4 to 6 and 7 to 9 there is the important difference that in the

case of the Z-section construction of the frame 26 according to Figs. 4 to 6 we are concerned with an elastic arrangement while the door seal which has been described with reference to Figs. 7 to 9 is rigid. Since accordingly the application pressure required to obtain a reliable seal is considerable, clamping screws 30 are provided by which the frame can be held firmly in an adjusted position relative to the door 12. These screws extend through expansion slots 27*b*, which extend to the outer edge of the sealing frame 27 in such a direction as to permit movement of the door frame 27 towards and away from the door seat when the clamping screws 30 are slack.

Figs. 10 and 11 show, respectively in a front view and in a longitudinal section, the door proper for that side hereafter called the machine side, at which it is necessary for a levelling rod to be introduced through an aperture 18 in order to enable the charge in the chamber *a* or *b* etc. to be levelled. The door 12 is constructed as a rectangular box. The door for the coke side of the chamber i.e. after the side at which the finished coke is forced out, consists throughout the height of the door frame 4 of a single piece, the attachment piece 16 with aperture 18 for the levelling rod being only provided on the door for the machine side. The box-shaped rectangular door 12 is provided with reinforcing ribs 19*a* at those points of the longitudinal side walls of the box at which transverse members 19 are provided for the lifting and shifting of the door. Arranged in the reinforcing ribs 19*a* are slots 19*c* into which the transverse members 19 are loosely slid to be secured against undesired displacement by securing pins 19*b*. Secured to the back of the box at the lateral edges are holding members 13 (see also Fig. 3) those at the foot of the door being so-called foot brick holders 14, which engage under a block of fire-brick or the like 13*a* by means of a supporting ledge. The holder members provided at the upper end of the machine-side door are formed with an inclined portion and are indicated by the reference number 15. A flap is employed during the opening and closing of the levelling rod aperture 18 to close the aperture 18 but has not been shown; this flap and its frame 16 are exchangeably connected with the door 12 by screws 16*a*. Most exposed to direct influences of temperature is the levelling-rod guiding member 17, which also is the part of the door subject to most stress, and it is for this reason exchangeably connected with the door and other exchangeable elements by screws 17*a* and 17*b*.

A coke-oven battery consists of a number of oven chambers *a* and *b* with interposed heating walls *c* as shown in Fig. 12. In front of the head of each heating wall *c* head plates 1 are arranged between the brick-work of the wall *c* and an adjacent anchoring standard 7 of the oven. The head plate carries at its back projecting lugs 2 and flat supporting members 3 in order to increase the adherence of the filler mass which is poured between the head plate 1 and the brick-work of the heating wall *c* and to ensure tightness of the oven head. The door frame 4 which surrounds the apertures of each individual chamber *a*, *b*, etc. at each of the two sides of the chamber abuts against the head plate by means of a projecting flange 4*a* provided on the door frame 1 and against the edge of the aperture of the chamber *a*, *b*, etc. by an inner edge of the frame carrying an asbestos cord 6. A sealing strip 5 is inserted under pressure between the flange 4*a* and the head-plate 1, in order to prevent leakage of the above-mentioned filler mass.

As shown in Fig. 12, the door frame 4 is pressed, by clamp means 8-11 secured to the head plate 1, against the brick-work of the oven in a gas-tight manner. In order to secure the clamp means the head plate 1 has welded to its front along each of its two longitudinal edges a plurality of connecting lugs 8. These connecting lugs are formed with a cut-out portion of hammer-head shape and the heads 9*a* of hammer-head screws 9 carrying nuts 9*b* are inserted with these cut-out portions from the side. These hammer-head screws 9 secure pressure arms 10 which are bridge-like steel castings serving to exert pressure on the one hand upon the door-frame flanges 4a and on the other hand, through the medium of steel screws 11, upon a stanchion 7 hereinafter called buck stay, thus pressing the flange 4*a* of the door frame against the head plate 1 while at the same time exerting pressure upon the buck stay 7. Due to the U-shaped construction of the pressure arms 10 the hammer-head screws 9 are at the same time locked in their position in the connecting lugs 8 against falling out. The construction of the connection between the head plate, the door frame, and the buck stay depends upon the construction of the buck stay 7; thus for example it may be necessary when box-shaped buck stays are used, to provide the buck stay with a projecting lug upon which the screws 11 acts.

What I claim is:—

1. A coke-oven door of the kind having outwardly projecting walls so as to form a box-like body which is equipped with locking mechanism including a bolt member mounted on the door body for rotary movement about an axis perpendicular to the plane of the door opening into and out of engagement with a pair of hook-shaped door-

holding abutments, and a fluid pressure operable actuating device arranged inside the box-like body adapted to rotate a sleeve arranged coaxially with the bolt member and connected to the latter by screw threads so that continued rotation of the sleeve when the bolt member has engaged the hook-shaped abutments causes the bolt member to be raised from the door so as to force the door onto its seat.

2. A coke-oven door as claimed in Claim 1, wherein the sleeve is provided with external screw-threads engaging a screw-threaded cap connected to the bolt member for common rotation therewith and is coupled by a connecting rod to the actuating device.

3. Coke-oven door as claimed in Claim 2, wherein a torsion spring is interposed between the sleeve and the screw-threaded cap so as to manually ensure common movement of these two elements.

4. A coke-oven door as claimed in Claim 2 or Claim 3, wherein the axial thrust of the cap is transmitted to the bolt member through a bearing bush mounted on a common shaft with, but axially adjustable in the bolt member.

5. A coke-oven door as claimed in Claim 2 or Claim 3, wherein the connecting rod is pivoted to a rocker arm of the sleeve.

6. A coke-oven door as claimed in Claim 4, wherein the bore of the bearing bush is of approximately double frusto-conical shape to permit swivel movement of the bolt member.

7. A coke-oven door as claimed in any preceding claim, which is equipped with an elastic metal sealing frame of substantially Z-shaped cross-section having oval apertures in one of the flanges, screws provided with eccentric discs being arranged to extend through these oval apertures in such manner as to enable the eccentrics to move the sealing frame towards and away from the door seat.

8. A modification of the coke-oven door as claimed in Claim 7, wherein the sealing frame consists of flat-section iron and is provided with expansion slots and wherein clamping screws extending through said slots are provided for securing of the frame in an adjusted position, the direction of the slots being such as to permit movement of the frame towards and away from the door seat when the clamping screws are slack.

9. A coke-oven door as claimed in any preceding claim, which is provided with a plurality of mechanisms adapted to be operated jointly by being coupled by individual connecting rods to a common actuating device.

10. A coke-oven door as claimed in any preceding claim, wherein those parts of the door which are subjected to high temperatures are detachably secured to the box-like door by screw means.

11. The modification of a coke-oven door as claimed in any preceding claim; in which suitably arranged cam surfaces are substituted for the screw thread connection of the sleeve and bolt member.

12. A coke-oven door as claimed in Claim 1, substantially as described with reference to Figs. 1 to 6, and 10 to 12 of the accompanying drawings.

13. The modification of the coke-oven door claimed in Claim 12, substantially as described with reference to Figs. 7 to 9 of the accompanying drawing.

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16, Kensington Square, London, W.8,
Chartered Patent Agents.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press,—1956.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

Fig. 1.

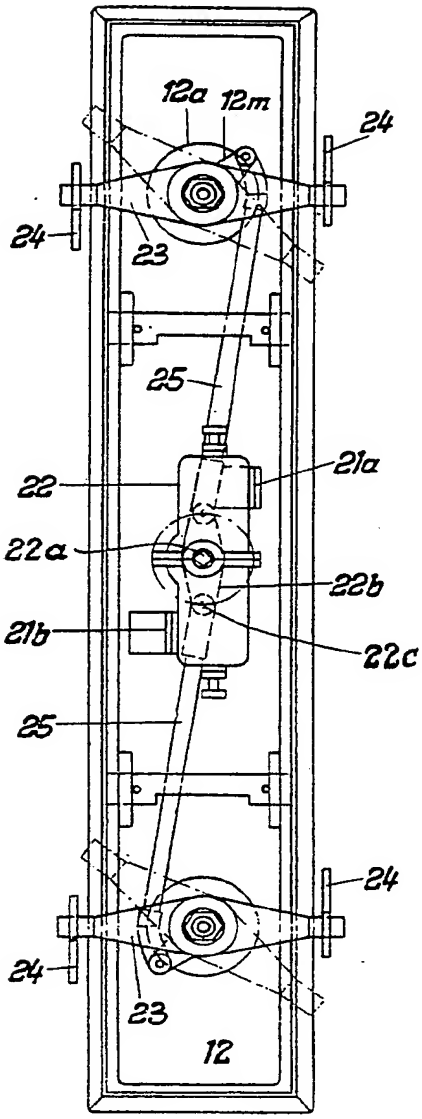
12a
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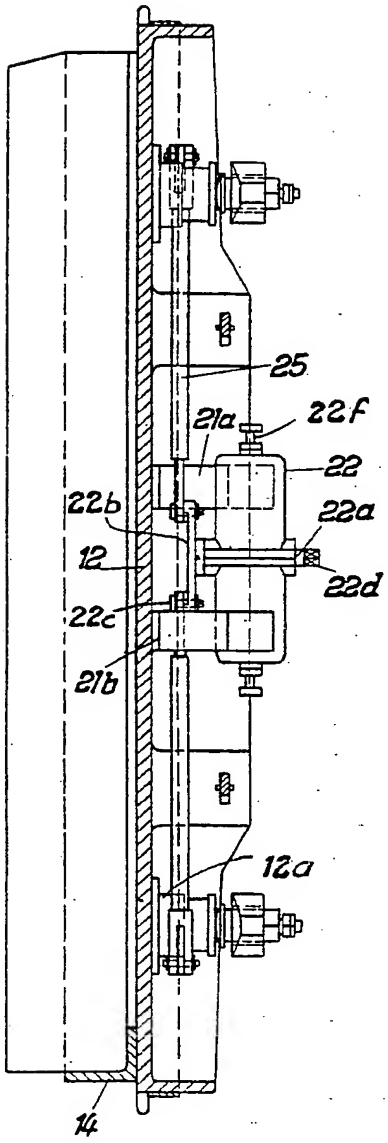
Fig. 2.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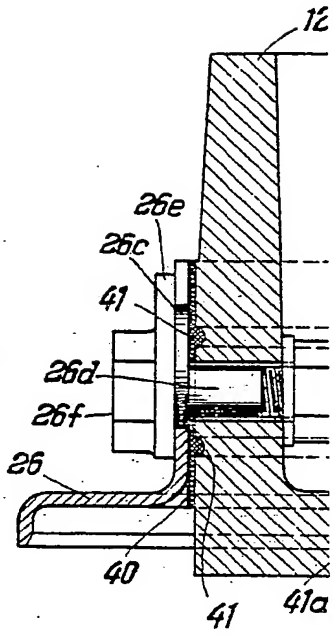
Fi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26e
26c
41
26d
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41a

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3 SHEETS

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SHEET 1

Fig. 4.

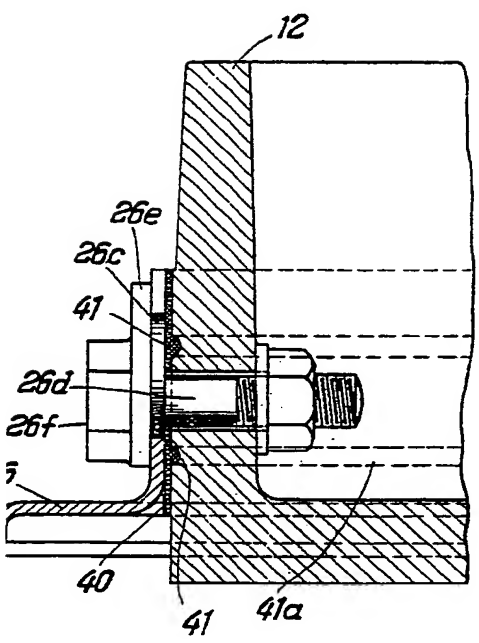


Fig. 5

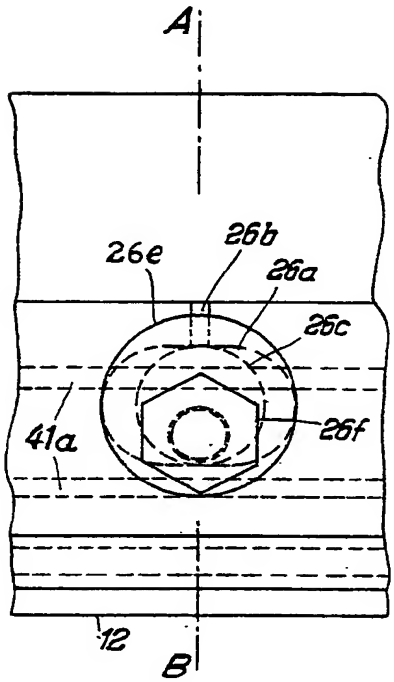
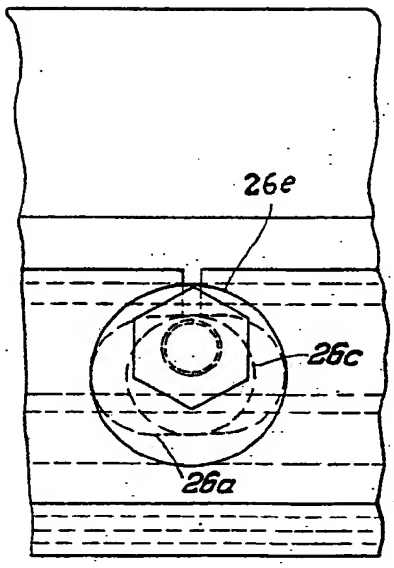


Fig. 6.



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SHEET 1

Fig. 1.

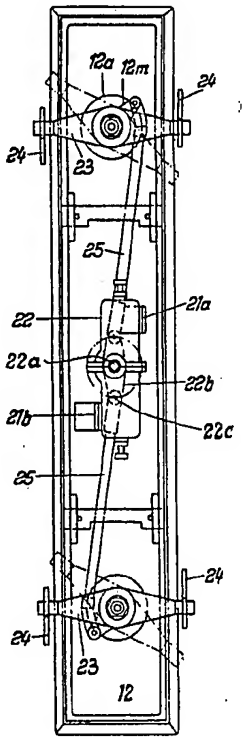


Fig. 2.

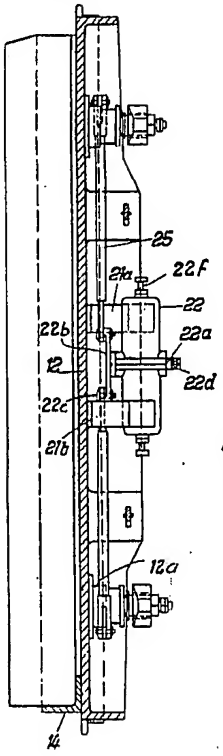


Fig. 4.

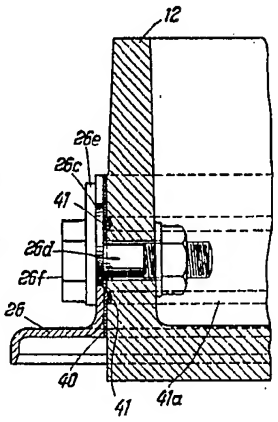
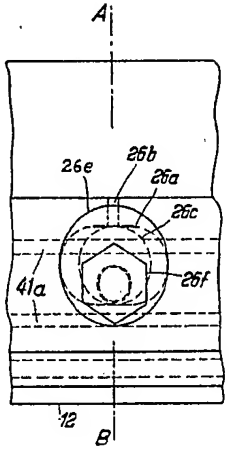


Fig. 5



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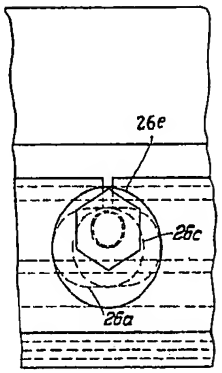

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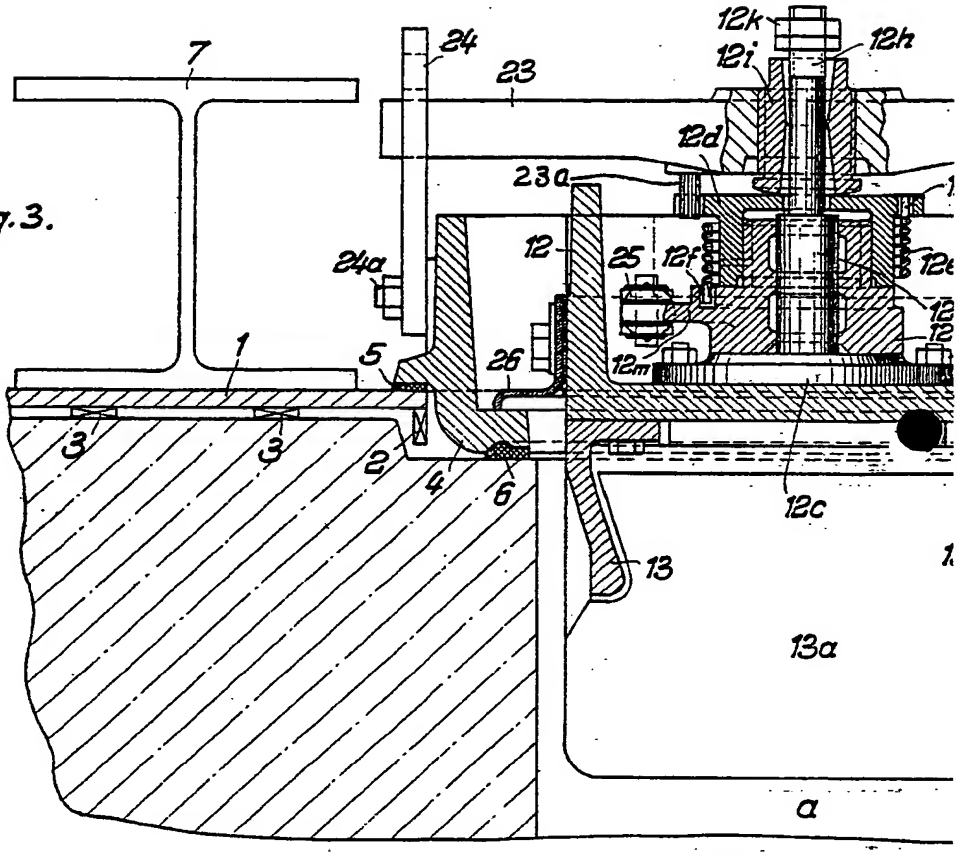
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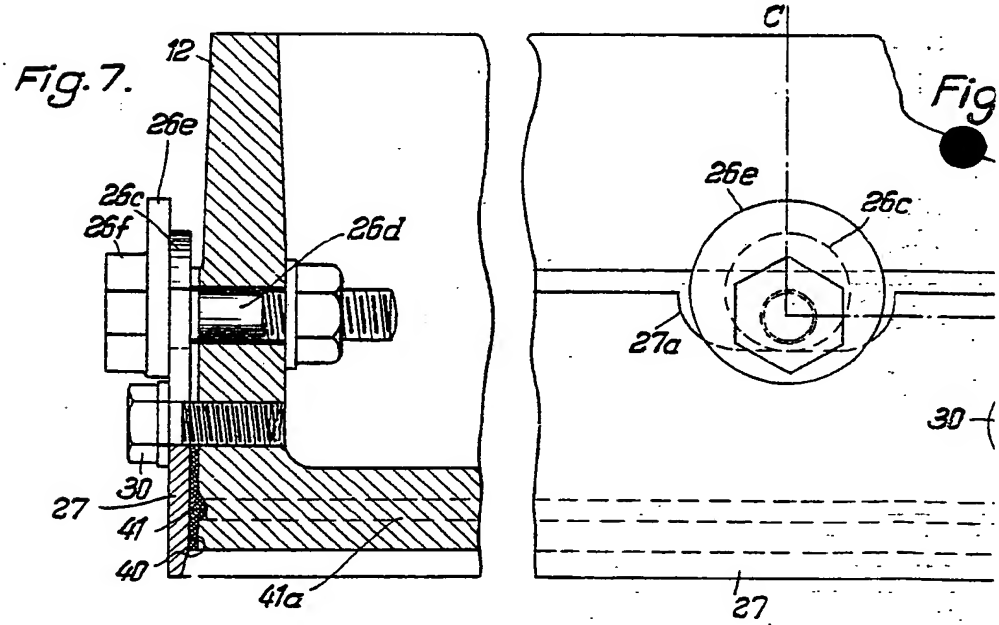
Fig. 7.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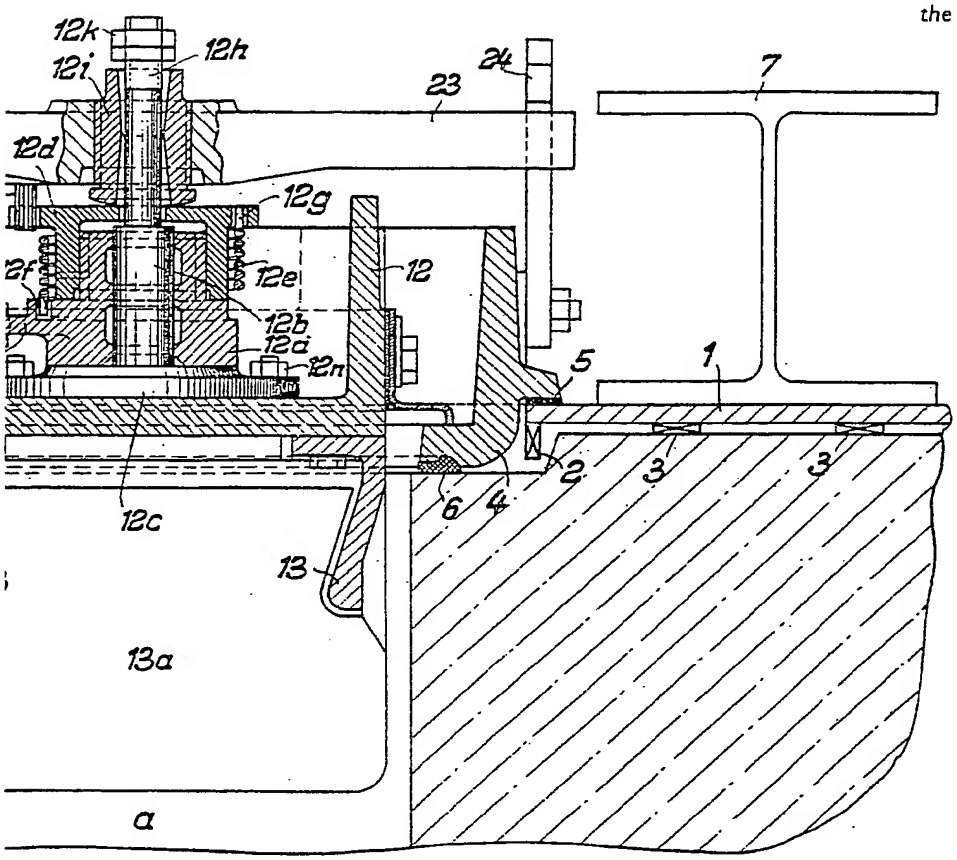

Fig.8.

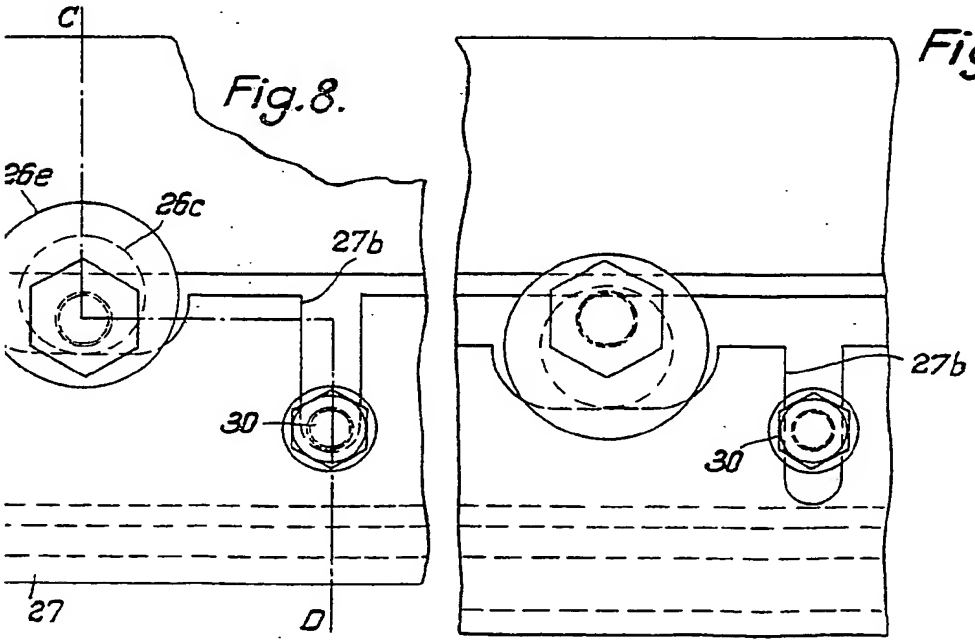

Fig.9.

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SHEET 2

Fig.3.

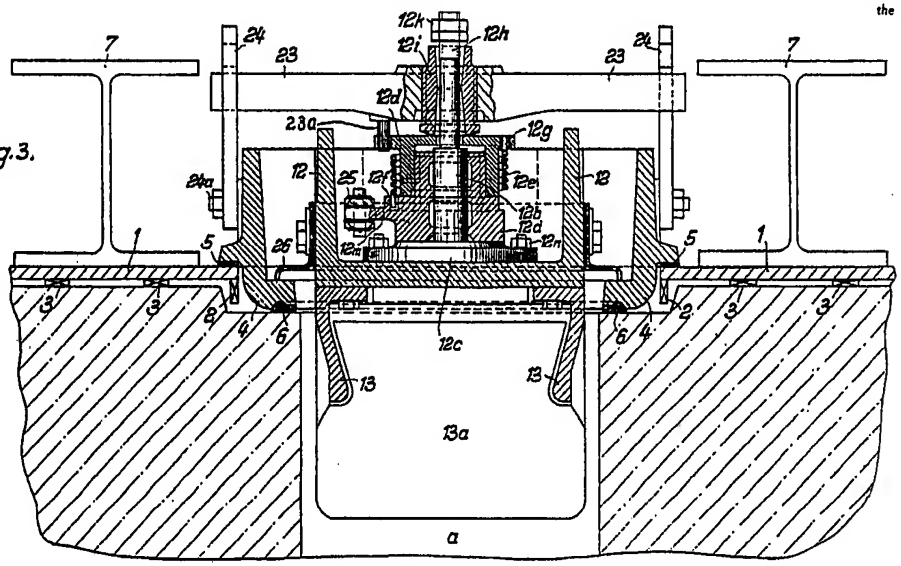


Fig.7.

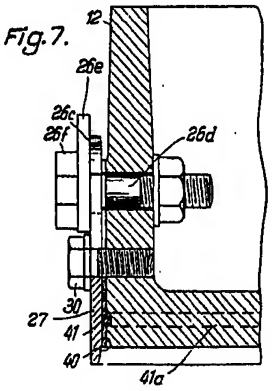


Fig.8.

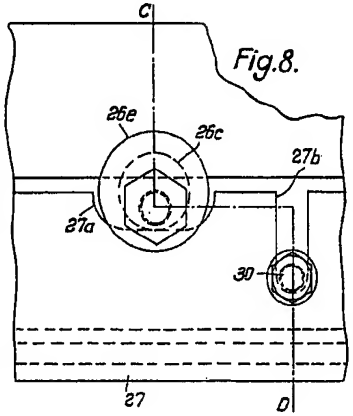


Fig.9.

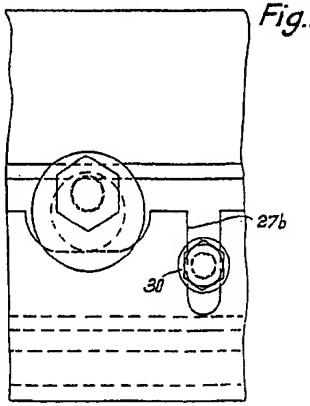
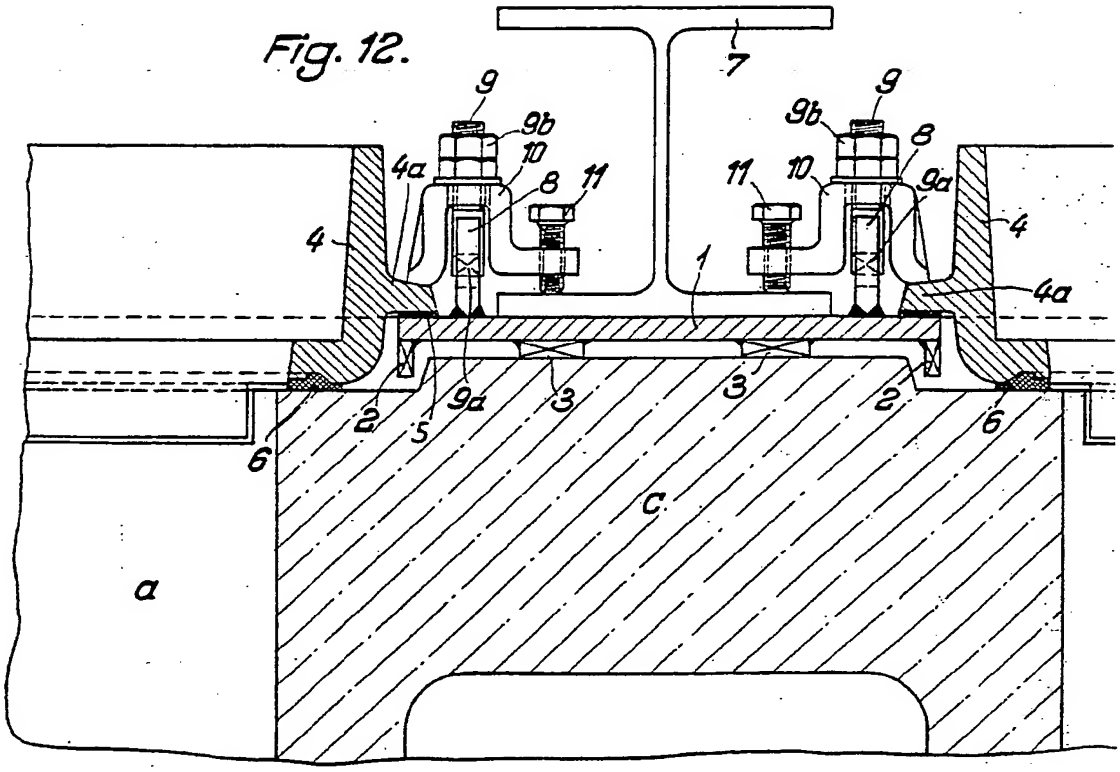


Fig. 12.



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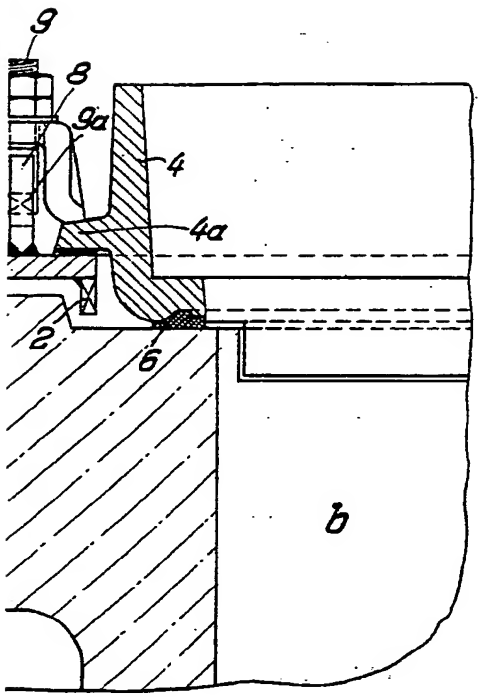
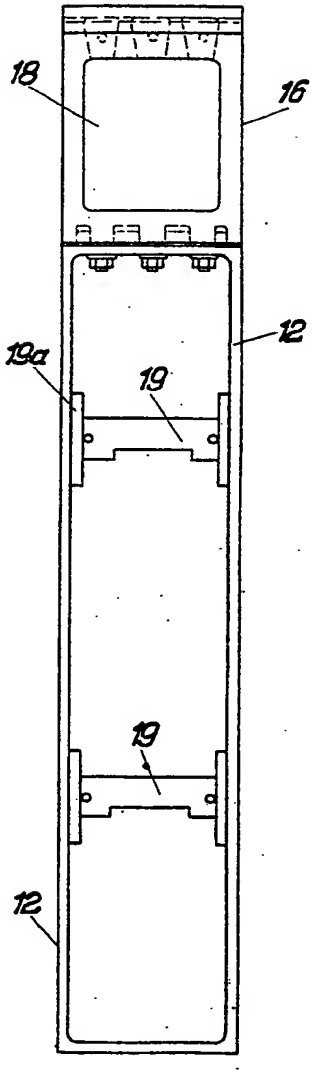


Fig. 10.



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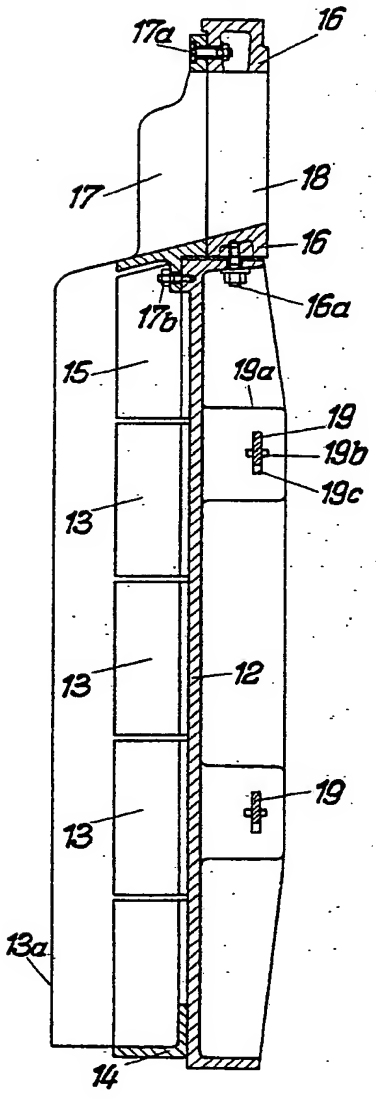

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SHEET 3

Fig. 12.

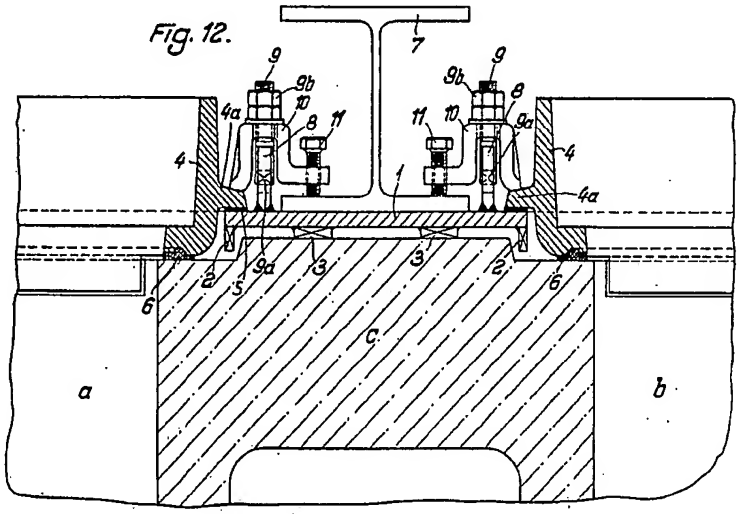

Fig. 10.

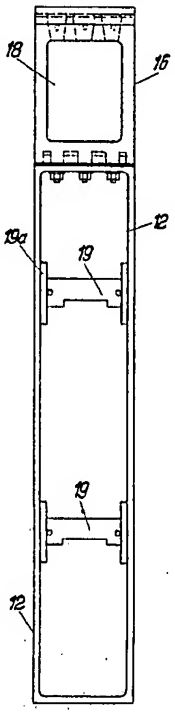

Fig. 11.